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240-kV Transmission Line 946/947L

Ellerslie-East Edmonton

May 1989



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240-kV Transmission Line 946/947L

Ellerslie-East Edmonton

May 1989

ENERGY RESOURCES CONSERVATION BOARD
APPLICATION NO. 880953

May 1989

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ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

TRANSALTA UTILITIES CORPORATION
 240-kV TRANSMISSION LINE
 ELLERSLIE-EAST EDMONTON AREA

Decision D 89-2
 Application 880953

1 APPLICATION AND HEARING

TransAlta Utilities Corporation (TransAlta) applied, pursuant to sections 12, 14, 17, and 18 of the Hydro and Electric Energy Act, for approval to construct and operate a double-circuit 240-kV transmission line, designated as 946/947L, from its Ellerslie substation 89S in the northwest quarter of section 27, township 51, range 24, west of the 4th meridian, to its East Edmonton substation 38S in the NE 31-52-23 W4M.

TransAlta submitted two alternative routes for consideration. The westerly Alternative 1, TransAlta's preferred route, would be 17.6 kilometres (km) in length while the easterly Alternative 2, located within the Edmonton and the Sherwood Park West Restricted Development Areas (RDAs), would be 21.1 km. The possible locations for the proposed facilities, and other key geographic features, are shown on the attached Figure.

The application was considered at a public hearing in Edmonton on 14-18 November 1988, with G. J. DeSorcy, P.Eng., J. P. Prince, Ph.D., and Dr. R. R. Orford, M.D., C.M., sitting. Written argument was subsequently filed with the Board to complete the proceeding. The dates for filing were 12 December 1988 for all parties and 23 December 1988 for TransAlta's response to matters raised by others in their final written argument.

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives
(Abbreviations Used in Report)

Witnesses

TransAlta Utilities Corporation
 (TransAlta)

J. G. Friesen

Panel 1 W. Nieboer, P.Eng.
 N. J. Brausen, P.Eng.
 S. E. Hodgkinson, P.Eng.
 J. S. Rohrich, R.E.T.

Panel 2 Dr. W. H. Bailey, Ph.D.
 Dr. J. S. Mandel, Ph.D.
 S. E. Hodgkinson, P.Eng.

Alberta Environment
 W. McDonald

F. Schulte, P.Eng.

THOSE WHO APPEARED AT THE HEARING (cont'd)

Principals and Representatives (Abbreviations Used in Report)	Witnesses
County of Strathcona No. 20 (The County) E. J. Walter, Q.C.	R. J. Powell, P.Eng. I. Evans, Reeve
Leduc-Strathcona Health Unit Dr. N. Bayliss, M.D.	Dr. N. Bayliss, M.D.
Hulbert Crescent Subdivision (Hulbert Crescent) J. R. Shaw R. M. Curtis	E. R. Schotte
Parents' Association, Colchester Elementary School (Colchester School) J. Kristensen	J. Kristensen S. Lindner P. Nissen C. Nissen Dr. S. M. Ross, Ph.D.
Sherwood Park Greenbelt Protection Association (Sherwood Park Greenbelt) P. H. Moxham	P. H. Moxham Dr. M. Adams, M.D. Dr. D. Brown, M.D. J. Pound, P.Eng. F. Gifford, P.Eng.
W. Hosford	W. Hosford
Edmonton Flying Club J. S. Rembish	J. S. Rembish
Interprovincial Pipe Line Company (Interprovincial) D. J. Jenkins	H. Sangster, P.Eng.
The City of Edmonton (The City) M. A. McAvoy	W. Cameron
Edmonton Metropolitan Regional Planning Commission (Planning Commission) P. Dickson	P. Dickson
Lehndorff Land Developments Inc. (Lehndorff) J. N. Agrios, Q.C.	K. Mackenzie
Industrial Power Consumers Association of Alberta D. E. Crowther	D. E. Crowther

THOSE WHO APPEARED AT THE HEARING (cont'd)

Principals and Representatives
(Abbreviations Used in Report)

Witnesses

Sherwood Park Fish & Game Association
A. Boyd

A. Boyd

Trison Instruments Ltd. (Trison)
L. L. Tachuk

L. L. Tachuk

Energy Resources Conservation Board staff
M. Bruni
J. Wilson, P.Eng.
T. Chan, P.Eng.
D. Novitsky
B. Olliver

1.1 Background

TransAlta made an earlier similar application (No. 830630) in 1983 proposing a double-circuit 240-kV transmission line along the route alignment identified in this application as Alternative 1, TransAlta's preferred route. A public hearing to consider Application No. 830630 had been scheduled for 25 October 1983. Prior to that hearing taking place, Alberta Environment advised TransAlta in writing that it would be necessary to locate the proposed 240-kV transmission line within the transportation and utility corridor of the Edmonton and Sherwood Park West Restricted Development Areas. TransAlta subsequently requested and received an adjournment of the hearing. Eventually it withdrew its application.

The project was deferred for several years as the general economic downturn resulted in a much slower than anticipated rate of electric load growth in northeast Alberta. The replacement application, currently under consideration, was filed on 2 June 1988.

2 ISSUES

The Board believes the following to be the major issues involved in the TransAlta application:

- Need for the proposed transmission line.
- Potential health effects of electric and magnetic fields (EMFs).
- Route for the proposed transmission line, to be discussed according to the following matters:
 - a) Regulatory Considerations,
 - b) Potential Effects on Health or Safety of Residents,
 - c) Environmental Issues,

- d) Economic and Technical Matters, and
- e) Planning and Land Use.

3 NEED FOR THE PROPOSED TRANSMISSION LINE

3.1 Views of TransAlta

TransAlta listed three principal reasons respecting the need for the proposed line.

- (i) Forecasts predict that in 1990/91 the northeast area electric load will exceed the capacity of the transmission system during single contingency outages.
- (ii) Power transmission to the northeast area would be totally disrupted if coincident outages were to occur in circuits 904L and 908L between Ellerslie substation 89S and East Edmonton substation 38S.
- (iii) A new double-circuit 240-kV line between the two substations, 89S and 38S, would realize savings from avoided transmission line losses of approximately \$300 000 per year.

The above-mentioned northeast area load includes demand in the east and northeast sections of the city of Edmonton, Sherwood Park, Fort Saskatchewan, the Redwater area, and parts of northeastern Alberta, extending to the Bonnyville-Cold Lake area. Among the customers there are major petro-chemical plants, oil refineries, and oil-field services, all of which typically have a high load factor. The load in this area represents approximately 20 per cent of the province's total electrical requirements.

3.2 Views of the Interveners

The City of Edmonton supported the need for the proposed facility, stating that Edmonton Power's load makes up 42 per cent of the applicant's current northeast area load forecast.

In its submission, Lehndorff stated that there is no clear evidence the proposed line would be required. However, it did not indicate its reason for doubting the necessity of the proposed facilities.

No other interveners questioned the need for the proposed facilities.

3.3 Views of the Board

The Board agrees that the electric load in the northeast area will grow over time and that TransAlta's forecast of that growth is reasonable. No evidence to the contrary was presented at the hearing.

Having reviewed TransAlta's loadflow predictions for 1990, the Board also agrees that the present 240-kV transmission system requires reinforcement. The Board therefore accepts that a new 240-kV line between Ellerslie substation 89S and Edmonton substation 38S is necessary to provide the appropriate transmission capacity. The new

line will also increase the reliability of the system since it could prevent disruption of as much as 20 per cent of the province's total electric load in the event of coincident outages of 240-kV lines.

With respect to the applicant's view on savings from avoided transmission line losses, the Board notes that reduced line losses follow automatically when a new line is introduced between a power source and a load in a transmission network. Whether or not this results in net benefits depends on how much additional capital investment is required to improve efficiency. In this case, the savings from reduced losses can be achieved only with a significant capital investment that must be justified on other grounds. That investment notwithstanding, to the extent that there are savings from reduced losses they support the case for the new line.

4 POTENTIAL HEALTH EFFECTS OF ELECTRIC AND MAGNETIC FIELDS

4.1 Views of the Interveners

The concerns of members of the Colchester School Parents' Association arose primarily through their reading of various published studies and media material such as articles in newspapers or magazines and television documentaries. The interveners' panel included Dr. S. M. Ross, a researcher at the University of Calgary. His appointment at the University involves studying the cellular basis of bioelectrical healing phenomena. He presented a review of the literature in this field along with a summary of his work in progress.

Dr. Ross stated that it has been known for hundreds of years that electric and magnetic fields affect living organisms. Throughout this period, electricity has been applied to humans and animals, and effects observed. By the end of the 18th century there was a well-established field of electrotherapeutics, and books on therapeutic use of electricity were published. Dr. Ross said that there were people who died from electrotherapeutic treatments; however, the issue was confounded when it was discovered that sometimes heart attack patients would recover when electricity was applied. Dr. Ross believed that misuse of electricity for therapeutic treatments stemmed from a lack of understanding of electricity by physicians and biologists.

Dr. Ross submitted that electrical currents occurring naturally in living tissues are carried by ions in solution. He indicated that Dr. J. Wikswo of Nashville, Tennessee, had discovered there were circulating electric currents at the growing tip of a sample of cultured dendrite derived from goldfish retinas. He stated that Dr. Wikswo had provided theoretical and experimental evidence to support that the currents were carried by calcium ions. The current densities were in the order of 10 to 100 nanoampere per square centimetre (10^{-9} A/cm²). He further stated that a number of electrical engineers modelling the kinds of electric currents induced in organisms by power lines found that current densities in the range of 0.5 to 100 x 10^{-9} A/cm² could be induced by power lines. He indicated that a typical power line electric

field of 10 kilovolts per metre (kV/m) might induce a current density of 15×10^{-9} A/cm² in organisms.

Dr. Ross described experiments by a number of researchers which had demonstrated that various species of animals can detect minuscule electric fields. He suggested that, if animals can detect minuscule extremely low frequency electric fields, there must be biological responses to the fields within the animals.

Dr. Ross also described a number of experiments where animal injuries were treated with electricity and where some corrections of injuries were observed. In other experiments, exposure to EMFs was shown to have an effect on cellular growth and composition in animals. The results of all the experiments led Dr. Ross to conclude that electric currents are important to the natural growth and healing of living organisms, although he is not sure whether they are the causes of the process.

With respect to his own studies, Dr. Ross submitted that he had examined the effects of static electrical fields on cells in tissue culture. The electric field strength which he used was equivalent to more than 10 000 kV/m in air. He observed that one response of cells to a uniform electric field is to align the long axis of each cell perpendicular to the direction of the current flow. However, he acknowledged that this response is not universal. As well, in response to TransAlta's cross-examination, he stated that he is aware that other researchers made specific comparisons between the effects of a static electric field at both 10-Hertz and 60-Hertz sinusoidal fields and did not find similar effects. He had also studied the possible migration of bone cells under the influence of a static electric field equivalent to more than 10 000 kV/m in air, and doubted that a 60-Hertz field could cause bone cells to migrate. His recent research has been concerned with the effects of EMFs on mammalian cells in vitro. He has been examining effects on proliferation of cells caused by extremely low frequency magnetic fields in the range of 100 to 11 000 milligauss. He submitted that under the influence of magnetic fields in the above range of magnitudes, he observed changes in cellular proliferation.

Dr. Ross concluded that effects on cells have been observed under the influence of both electric and magnetic fields. Notwithstanding that the magnitudes of both electric and magnetic fields applied were much higher than those associated with power lines, he submitted that more work should be done to determine whether or not there could be health effects due to power line fields. Colchester School, therefore, recommended keeping all new construction of power lines at a reasonable distance from populated areas until such time that the risks could be conclusively shown to be insignificant.

Sherwood Park Greenbelt submitted that, while available evidence on health effects due to power line EMFs might be inconclusive, it had provided definite grounds for concern. A great deal of research is now under way throughout the world on the EMFs health effect issue. The intervener believed that, while this type of research is continuing, the responsible course would be to take every opportunity to minimize public

exposure. It suggested that, since there is abundant land available for housing development in and around Edmonton, it would be prudent to place a moratorium on all development within at least 400 metres (m) of existing power lines until scientific research into the health hazards has been completed.

The County of Strathcona assembled a substantial collection of scientific articles on health effects due to EMFs. While it did not provide any expert witnesses to speak to health concerns, the County commented that it is concerned that there is no conclusive scientific evidence stating that there is no adverse health effect. Therefore, it opposed Alternative 2, in part, because there could be an unacceptable health risk to residents in the County.

Leduc-Strathcona Health Unit stated that a review of the literature suggested that the present expert knowledge of the effects of EMFs is inadequate and inconclusive. Because the effect of EMFs on children is not yet known, it is against locating the proposed line 80 m from Colchester School. Similarly, locating the proposed line 30 m away from two residences along Alternative 2 would be unacceptable. Although the same arguments for health concerns would hold in either Alternatives 1 or 2, the intervener contended that for Alternative 1, the extent of the separation between residential development and power lines should primarily be the choice of the developers.

Mr. J. R. Shaw and the residents of Hulbert Crescent Subdivision submitted that, with respect to health hazards, the evidence is not clear or conclusive in either direction. Sufficient evidence exists to demonstrate that the safety of power lines ought not to be taken for granted and further studies may well demonstrate that they are a substantial hazard to human health. However, unless the Board should come to the conclusion that the health hazards are so great as to nullify the need for the power lines, or unless the Board should conclude that there are mitigating circumstances which can reduce or avoid the health hazards, it is clear that some element of the population will be exposed to the health hazards no matter where the power line is located.

Lehndorff acknowledged that there are numerous submissions on the issue of health which expressed sincere concern. Notwithstanding the lengthy evidence that was presented, the intervener submitted that it is apparent that there is no conclusive evidence that there is a health hazard caused by transmission lines. The intervener further submitted that, if there is any doubt on this issue, or if there is any inclination on the part of the Board that there is a health hazard, then the transmission line should not be built anywhere at this time. Out of an abundance of caution and in view of the concerns that have been expressed, the intervener believes that the preponderance of evidence on health would result in a determination that any future transmission line be restricted to the RDA. The evidence indicates that, if there is a danger, it would be to those in immediate proximity to the transmission line as opposed to those who are at a considerable distance from it. Lehndorff submitted that it would be both prudent and responsible, in

the interests of long-term planning, to minimize these risks by restricting any transmission lines to the RDA.

4.2 Views of TransAlta

4.2.1 Electric and Magnetic Fields Associated with the Proposed Line

TransAlta submitted that EMFs occur naturally and are also produced wherever an electric current exists. Electric field strength is commonly measured in kV/m and magnetic field strength in milligauss. To put these units into perspective, TransAlta cited that the earth's EMFs are approximately 1.14 kV/m and 600 milligauss, respectively. Typical magnetic fields produced by common appliances are 1 to 25 milligauss. Within most homes, magnetic fields produced by household wiring and appliances fall in the range between 1/2 and 3 milligauss.

TransAlta stated that electric and magnetic field strengths due to a transmission line can be measured or calculated from computer models. The electric and magnetic fields generated by the proposed line would be the same along either of the alternative routes. However, because of the presence of adjacent 240-kV and 138-kV lines along Alternative 1, the fields at the edge of the right of way would be different from those of Alternative 2.

The electric field of a transmission line is directly related to the voltage of the line. Since transmission lines tend to be operated within a very small range of voltage variations and the geometry of the conductors seldom changes, the associated electric field pattern tends to be stable over time. TransAlta submitted that the maximum electric field strength anywhere within the right of way due to the proposed line would always be below 2 kV/m for either route.

The magnetic field of a transmission line is directly related to the current flowing in the conductors, the configuration of the conductors, and their height above ground. The line current depends on the load conditions. Under maximum line loading, the calculated peak magnetic field strength at the edge of the right of way, 1 m above ground, would be 77 milligauss and 42 milligauss for Alternative 1 and Alternative 2, respectively.

The strength of both electric and magnetic fields decreases proportionately with the increase in distance from a transmission line. At the Colchester School, which is approximately 80 m away from Alternative 2, the electric field strength due to the proposed line would be negligible. The associated magnetic field strength would be about 1/2 milligauss. At 400 m away from Alternative 2, both the electric and magnetic field strengths due to the proposed line would be negligible.

4.2.2 Biological Studies on Plausibility of Health Effects Due to Electric and Magnetic Fields of Transmission Lines

Sixty-Hertz electric fields can induce similar fields in a conducting object. However, the electric field strengths induced inside the conducting object are lower than those of the external fields by many orders of magnitude. Dr. W. H. Bailey, one of TransAlta's expert witnesses, submitted that human bodies are good conductors in comparison with air. Electric fields induced in a body are one hundred thousand to ten million times lower in strength than the external field to which the body is exposed. Thus the body effectively shields the interior from the external electric field.

The permeabilities of biological materials to magnetic fields are very similar to air, i.e., introduction of a biological subject to a magnetic field has a negligible effect on the field, and the magnetic fields inside the subject will be essentially the same as those outside the subject. Dr. Bailey submitted that scientific evidence suggests that biological effects from time-varying magnetic fields are not likely to occur until the currents induced within the body by the magnetic field approach those that are generated by nerves and other tissues. The World Health Organization has concluded that it would be unlikely to expect significant biological effects from exposure to magnetic fields which induce electric currents within the body that are below the level produced by the beating of the heart. The magnetic field strength has to be about 30 000 milligauss to induce the same magnitude of currents as those within the heart.

Experiments have been done with animals exposed to fields of much greater intensities than those produced by a transmission line. For example, in an experiment conducted for the New York State Power Lines Project, two strains of mice were exposed to a 50-kV/m electric field and a 10 000-milligauss magnetic field over three generations. No adverse effects were observed.

Dr. Bailey submitted that chances are very low for a person to be exposed in the normal everyday environment to 60-Hertz EMFs at the high intensities used in some of the experiments.

Dr. Bailey summarized all the information referred to by the interveners into four categories: (1) non-scientific materials, documentaries on television, and articles in magazines; (2) irrelevant studies; (3) laboratory studies; and (4) epidemiological studies. The last item, epidemiological studies, is discussed in Section 4.2.3.

1. Non-scientific Materials, Documentaries on Television, and Articles in Magazines

Dr. Bailey submitted that the media often take scientific information out of context and with no peer review. Reviewing the primary scientific information directly is therefore more instructive.

2. Irrelevant Studies

Several studies cited by the interveners included studies of microwaves, radio waves, and non-sinusoidal wave forms. These studies have no relevance to the 60-Hertz fields generated by power lines.

3. Laboratory Studies

Dr. Bailey summarized references cited by interveners and other additional laboratory studies dealing with 60-Hertz EMFs.

He commented that laboratory research can be designed to control variables precisely for investigating cause-and-effect relationships between agents and study objects. It is, thus, more powerful in determining causation than are epidemiological methods.

Dr. Bailey submitted that, in reviewing the large amount of literature on 60-Hertz fields, he used criteria established by the National Academy of Sciences in 1987 to assess the quality and the reliability of the studies. The Academy's review criteria are:

- The biological and engineering methodologies should be sound and appropriate for the experiment or study.
- A given experiment should be internally consistent with respect to the effects of interest.
- The experimental and observational techniques, methods, and conditions should be objective. "Blind" scoring (where the investigator making the observations is unaware of the experimental variable being tested) should be used whenever there is a possibility of investigator bias. "Double-blind" protocols (where neither the investigator making the observations nor the experimental subject is aware of the experimental variable being tested) should be used when the experimental subjects' perceptions may be unwittingly influenced by suggestions.
- The experimental techniques should be chosen to avoid effects of intervening factors such as microshocks, noise, corona discharges, vibration, and chemicals.
- Extreme care should be taken to determine the effective extremely low frequency fields, voltages, or currents in the organism.
- The sensitivity of the experiments should be adequate to ensure a reasonable probability that an effect would be detected if it existed.
- If an effect is claimed, the results should demonstrate it at an acceptable level of statistical significance by application of appropriate tests.

- The results should be quantifiable and replicable. In the absence of independent confirmation, the result should not be viewed as definitive.

Based on these criteria, and taking all the cited 60-Hertz studies into consideration, Dr. Bailey observed that 60-Hertz EMFs could not be identified as hazardous agents. Some studies which initially were presented as showing such effects could not be replicated. In others, it was shown that the initial experiment was not properly carried out. For example, a study by Dr. A. A. Marino failed to properly ground the cages of the animals being experimented upon. This caused the animals to receive microshocks when they tried to drink, which led to dehydration. Similarly, experiments concerning the transport of calcium ions presented particular problems with respect to the interpretation of data obtained with the chosen assay systems. Experiments designed to overcome these problems could not replicate the original findings.

Dr. Bailey gave particular attention to the issue of whether or not EMFs may cause cancer or contribute to cancer growth. Although this issue has been raised, it is not because any clinically detectable tumours have been observed in animals exposed to EMFs. In response to the Board's question, Dr. Bailey stated that to his knowledge there has been no detailed microscopic study of animal tissue structure which was subjected to long-term exposure to EMFs at multiple sites. However, he submitted that the New York State studies have shown that EMFs do not initiate cancer even in animals receiving very high levels of exposure to EMFs over several generations. There is no indication that mutagenic damage can be produced, nor is the ability of cells to repair damage from mutagenic agents impaired. Nor did a review of the literature uncover data that would demonstrate that these fields promote tumour development. The interpretation of the data, as reported by Dr. J. L. Phillips, that colon cancer cells grew faster when they were exposed to EMFs, has been dismissed by the scientists who reviewed this work for the New York State project. Moreover, subsequent experiments by Dr. M. M. Cohen employing even greater field intensities were unable to confirm Dr. Phillips' results.

Thus, according to Dr. Bailey, a review of the scientific literature has not implicated electric and magnetic fields as contributors to any step of the cancer process.

Dr. Bailey concluded that 60-Hertz EMFs from high voltage transmission lines would not be harmful to humans. He further stated that other expert scientific panels - namely, the Academy of Sciences, World Health Organization, American Institute of Biological Sciences, State of Florida Electric and Magnetic Field Advisory Commission, and New York State Public Service Commission - also concluded that there is no evidence to suggest that EMFs due to power lines pose a health hazard.

4.2.3 Epidemiological Studies on Possible Health Effects Associated with Power Lines

TransAlta's second expert witness, Dr. J. S. Mandel, testified that all the epidemiological studies on the long-term health effects of EMFs were of the observational type. There have been no long-term human experimental trials.

Observational studies are designed to identify and measure the degree of association between factors, such as occupational or environmental exposures, and occurrences, such as disease, injury, or death. Criteria for assessing whether or not a causal relationship exists between a factor and an occurrence include: (1) strength of association, (2) consistency, (3) coherence, (4) temporality, (5) biological plausibility, (6) dose-response, (7) absence of confounding, (8) absence of bias, and (9) specificity. Dr. Mandel believes that one should evaluate all the epidemiological data accumulated in an area of interest. If the data meet all the above-mentioned criteria, then causation is likely.

There are two types of observational epidemiological studies: (a) descriptive studies, which are considered hypothesis-generating, and (b) analytical studies, which are considered hypothesis-testing (and, therefore, generally preferable as a means to infer causation). In the EMFs literature, studies to date have been primarily descriptive. There have been a few analytical studies such as the Wertheimer study and the Savitz study.

Dr. Mandel submitted that the majority of the epidemiological studies fail to show any relationship between human exposure to EMFs and death from leukemia. He contended that the Wertheimer study, which has often been cited as showing such an association, was not done blind, i.e., the investigator, in assessing the exposure to EMFs, was aware of whether a house was occupied by a case subject who had leukemia or by a comparative control subject who did not have leukemia. The study was not based on actual measurements of magnetic field. Exposure of study subjects was characterized according to the wiring configuration and proximity of overhead power lines to their homes. It has been shown that exposure assignments did not correlate very well with actual measurements. Wertheimer did not conduct a match analysis in which a control subject is required to match each case subject. Furthermore, she was not consistent in using the addresses of the cases and controls, and did not properly analyse potential confounders.

Another study, by Dr. D. A. Savitz, which had also allegedly demonstrated an association, was criticized by Dr. Mandel on the basis that the author was able to interview only 70 per cent of his subjects and measurements of exposure were taken in only 36 per cent of the cases. Where exposure to EMFs was actually measured, no relationship could be observed between the disease and EMFs. The only statistically significant elevated odds ratios were in those analyses where the exposure was estimated using wiring configurations. However, with as many comparisons as were made with the data available, it is possible that such results were obtained purely by chance.

Dr. Mandel felt that the author's interpretation of the data was exceedingly generous.

Dr. Bailey submitted that Dr. Savitz's co-worker, Dr. H. Wachtel, has stated on many occasions that he does not believe that EMFs is the cause of the reported association. Dr. Mandel also submitted that with regard to all available occupational studies Dr. Savitz himself recently stated:

- (1) "Unless electromagnetic fields are thought to be general human carcinogens, some other risk factor or study bias must be operating..." and
- (2) "The use of usual occupation on death certificates or cancer registry records provides a very crude measurement of exposure. None of the studies of leukemia have validated the assumption that the men presumed to be exposed to such fields are, in fact, exposed. As noted by Bonell, electricians working in homes usually work on electrically dead equipment, while telecommunications engineers are exposed to levels of power frequency electromagnetic fields no higher than those found in an average home with a wide variety of domestic electrical appliances.

Several studies have examined the actual electric field exposures among power plant workers. Most workers received little exposure to electric fields and even exposed workers spent relatively little time in high level electric fields."

Another study was done in parallel with the Savitz study by Dr. R. G. Stevens, who found no correlation between wiring configurations or measured EMFs and leukemia in adults.

A study by Dr. L. Tomenius had also been cited to have linked leukemia with power lines. However, in this study a greater proportion of leukemia cases in the "exposed" group was among those who lived farthest from power lines, the reverse of what would be expected.

Dr. Mandel also submitted that the rate of increase of leukemia had not followed the rate of increase of electric energy consumption despite a remarkable seven-fold increase of per capita consumption from 1950 to 1985 in the United States. He contrasted this with the relationship between smoking and lung cancer where epidemiological studies over many years have consistently demonstrated a causal relationship and where the increase in lung cancer rate has paralleled the increase in cigarette consumption, both in men and women.

Dr. Mandel concluded that it is not possible to infer associations between EMFs and adverse human effect from the evidence which he had reviewed and from that cited by interveners.

4.2.4 TransAlta's Conclusion on Potential Health Effects Due to the Proposed Line

TransAlta, in summary respecting this matter, submitted that the scientific evidence does not indicate any adverse health effect from the level of EMFs associated with the proposed line. Notwithstanding, TransAlta recognized that the public's perception of risk might diverge significantly from the actual risk as determined by a scientific assessment of hard evidence or rational deliberation by experts.

TransAlta stated that it will continue to monitor results of high-quality scientific research related to the 60-Hertz EMFs health effect issue.

4.3 Views of the Board

The issue of biological effects from extremely low frequency EMFs is controversial. There are proponents on either side of the question as to whether or not EMFs from high-voltage transmission lines cause such effects among people who reside near them. In the course of this hearing, many participants contributed to the discussion of this issue.

The Board appreciates the applicant and the interveners making health experts available at the hearing. Their evidence, presented from both laboratory research and epidemiological perspectives on possible health effects due to EMFs, was extensive and informative.

The Board concurs with those participants in the hearing who stated that non-sinusoidal EMFs studies are irrelevant to the issue of possible biological hazards of 60-Hertz EMFs. Hence, although TransAlta submitted that the strength of the earth's magnetic field is significantly larger than that of a 240-kV transmission line, the Board notes that the earth's field is also non-sinusoidal and, therefore, has no direct relevance to the question of biological consequences due to power line fields.

A large number of experimental studies of the effects of EMFs on animals and some other organisms were cited in the submissions. Several studies were not directly relevant, even though they did show biological effects, because they involved the use of non-sinusoidal wave forms and/or high-frequency radiation that would cause biological effects through heating (e.g., microwaves) or through ionization (e.g., x-rays). None of the studies on 60-Hertz sinusoidal EMFs presented has shown harmful biological effects at levels likely to be found in the vicinity of a 240-kV high-voltage transmission line.

Several epidemiological studies have suggested an association between leukemia, and in some cases brain tumours, and occupational or environmental exposure to EMFs. Other studies, however, have failed to show any such association, and those showing effects have been criticized on methodological grounds. In addition, if leukemia and transmission lines were linked, the Board believes an increase should appear in the incidence of leukemia, paralleling the substantial

increase since 1950 in the use of electric power in residential areas. This has not occurred.

Both laboratory and epidemiological evidence concerning extremely low frequency EMFs has been reviewed by many independent authorities over the past several years, including the National Academy of Sciences (1977), World Health Organization (1984 and 1987), the American Institute of Biological Sciences (1985), the State of Florida Electric and Magnetic Fields Advisory Commission (1985), and the New York State Public Service Commission (1988). These authorities have consistently concluded that no adverse health effects have occurred from human exposure to environmental EMFs.

From the evidence presented at the hearing, the Board concludes that the electric field strengths that would exist at the edge of the right of way of either alternative are comparable to those that already exist along Alternative 1. Also, the magnetic field strengths that would exist at the edge of either right of way would be comparable to the ambient magnetic field strength produced by household appliances and wiring.

The Board also concludes that considerable biomedical research has been conducted to date and that it has not demonstrated harmful biological effects caused by 60-Hertz sinusoidal EMFs due to high-voltage transmission lines. Epidemiological and laboratory research currently under way, or to take place in the future, could modify this conclusion. However, while the Board supports the continuation of such research, it cannot base its decision concerning power line placement in the present case on speculation that health effects could possibly be demonstrated by future research.

The Board, therefore, concludes that there is no evidence of health effects of the proposed 240-kV transmission line that would justify denial of the application. On the same basis, the question of health effects should not influence its decision on the appropriate location of the line.

5 COMPARISON OF ALTERNATIVE ROUTES

TransAlta proposed two alternative routes which have been evaluated in accordance with the categories set out below:

- 5.1 Regulatory Considerations,
- 5.2 Potential Effects on Health or Safety of Residents,
- 5.3 Environmental Issues,
- 5.4 Economic and Technical Matters, and
- 5.5 Planning and Land Use.

Certain portions of the evidence apply to more than one factor. For ease of understanding, and to avoid repetition, the Board has dealt most extensively with the evidence in Section 5.2.

5.1 Regulatory Considerations

5.1.1 The Evidence

TransAlta stated that in the long term it favours Transportation and Utility Corridors (TUCs). It would have applied for only one route, within the RDA, if not for the availability of the existing transmission-line corridor, Alternative 1, with its concomitant economic, technical, and environmental benefits. TransAlta prefers retaining the RDA's utility corridor for future transmission lines, for which it does not foresee a requirement for at least the next 10 years.

TransAlta contended that placing transmission lines within the RDA is not mandatory. It noted Alberta Environment's testimony that either Alternative 1 or 2 would be acceptable.

Alberta Environment indicated that the Sherwood Park West RDA was established in the mid-1970s. The location of the RDA was determined by the ring road which had been established earlier by Alberta Transportation.

Plans for the TUC component of the RDA were first completed in 1979, with space allotted for major power lines, pipelines, municipal services, and other related facilities. Further refinements were made to the plans on a continuous basis. As part of the planning process, Alberta Environment retained the services of the consulting firm of Stewart Weir and Co. to assist in its final detailed planning of the northeast Edmonton corridor. A copy of this report completed in May 1985 and entitled "Edmonton Transportation/Utility Corridor Reassessment" was provided at the hearing by Alberta Environment.

Alberta Environment reiterated that this TUC component was designed to maximize the use of the corridor while providing usable space in areas that will eventually be surrounded by urban development.

Alberta Environment submitted that the province has acquired ownership of over 75 per cent of the lands in the TUC and is actively pursuing acquisition of the remaining properties. Alberta Environment concluded by indicating that either route, as proposed by TransAlta, would be acceptable.

The City of Edmonton indicated support for the TUC concept for locating transmission lines around Edmonton. It believes that all the parties endorsing the TUC concept should zealously endeavour to implement the concept. The City submitted that, since the RDA had been legally created and was in place, the subject transmission line should be placed in the RDA at this time so that the effect on future land use within the urban area would be minimized.

Lehndorff stated that the Edmonton RDA, which was developed in 1974, was designed with a TUC that could accommodate a ring road, transmission

lines, pipelines, and other utilities. It noted that the provincial government has acquired over 75 per cent of the affected lands in the Edmonton area. It predicted the provincial government would acquire all lands in the TUC and compensate all affected parties. Lehnendorff submitted, therefore, that placing the proposed transmission line within the RDA would be consistent with the long-term plan for urban development.

The Planning Commission also supports the RDA concept. It, therefore, supported Alternative 2 for the proposed transmission line.

Colchester School stated that constructing a line along Alternative 2 would contravene the intent of the RDA. It believes that the RDA was established to prohibit any development detrimental to the natural state of the area. Colchester School also noted Alberta Environment's submission that either alternative would be acceptable.

Hulbert Crescent and Mr. Shaw stated that the proposed line should not be located along Alternative 2, since placing a power line in the middle of the RDA would sterilize much of it and limit the number of pipelines that could be accommodated. They further contended that placing a line in the RDA would be unwise, since an existing corridor already provides a suitable alternative. They stated that both TransAlta and The City of Edmonton had defined the existing right of way along Alternative 1 as a corridor because there are both power lines and pipelines in it, whereas there are no power lines in the RDA. Furthermore, they pointed out that articles written by Mr. Weir stated that existing corridors should be fully used before new ones are created. They also argued that the Minister of the Environment lacks the authority to order the locating of transmission lines in the RDA. Hulbert Crescent and Mr. Shaw, however, did indicate that approval of Alternative 1 would not preclude use of the RDA in the future.

The County of Strathcona stated that locating the proposed transmission line along Alternative 1 would comply with the provincial government's existing policy. It noted Alberta Environment's view that either of the proposed alternatives would fulfil corridor planning objectives. It also observed that the County's General Municipal Plan recommended that future power lines and pipelines should be encouraged to locate outside of residential areas. The County would, therefore, not support Alternative 2 within the RDA, believing it would conflict with existing residential development.

Mr. W. Hosford stated that an RDA should be a green belt where no construction takes place.

Sherwood Park Greenbelt does not oppose the TUC principle facilitating the orderly installation of utilities. It believes that simply because the RDA is there is not sufficient reason to place the proposed line in it. However, with proper planning, future lines could be incorporated into the corridor.

5.1.2 Views of the Board

The Board has reviewed the submissions regarding regulatory considerations respecting the use of the RDAs. The Board believes it is important to understand the intent of the TUC within the RDA. Alberta Environment's policy witness, Mr. Schulte, stated that the TUC has two roles: to accommodate utility and transportation facilities and to provide green space adjacent to urban areas. Furthermore, the witness indicated it is not the provincial government's intent to assign a priority to either purpose at the expense of the other; they are essentially equal. The Board notes the view of many interveners that the RDA is intended solely as a green belt, so that utilities installed in such a green belt would contravene that intent. However, the Board cannot concur, given that both legislation and government policy provide for the development of a TUC within the RDA.

At the same time, the Board observes that there is no existing legislation or government policy that would require the proposed line to be located in the RDA. Alberta Environment's policy witness indicated that approval of the line and its location were matters that should be decided by the Board. The Board agrees with this position as there are no regulations governing TUCs within RDAs that, by themselves, would dictate the decision on the application before it.

The Board's view is that route Alternative 1 is a de facto corridor, albeit non-RDA, and its use is not precluded if it is found to be in the public interest. It presently contains both power lines and pipelines that have affected future use of the land and carry visual implications for current and future residents. Similarly, route Alternative 2, in the RDA corridor, could be chosen if the public interest favoured that alignment, even though the most contentious portion of the route has no existing electric transmission lines. The Board will evaluate the evidence for both routes considering all relevant factors and will make its choice according to those factors. They are discussed in Sections 5.2 to 5.5 inclusive.

5.2 Potential Effects on Health or Safety of Residents

Potential effects on health associated with exposure to EMFs have been addressed in Section 4 of this report. The Board has concluded that the question of health effects should not influence the decision regarding the location of the line. Therefore, such effects will not be discussed further here and only evidence concerning other safety aspects of the proposed transmission line is dealt with.

5.2.1 The Evidence

TransAlta indicated that along Alternative 2 there are nine residences within 100 m of the centre line of the transmission line, mainly those in the Hulbert Crescent subdivision. Along Alternative 1 there is only

one such residence. Residents of Sherwood Park backing onto the RDA would be located approximately 400 m and Colchester School would be some 80 m from Alternative 2.

Hulbert Crescent objected to Alternative 2, since the proposed line would pass directly over the residential subdivision. It had concerns about the safety of children who could climb the towers, the danger of shocks from electric currents induced in fences, and the danger associated with the use of herbicides to control vegetation on the right of way.

Colchester School noted that the school boundary and playground are less than 80 m from the alignment of Alternative 2. It considered the close proximity of the proposed line very dangerous to children flying kites or playing near the towers. Moreover, if Alternative 2 were approved, the proposed line would partially surround the school on three sides. Thus, should the towers fall during a severe storm, the school could be isolated from all access routes.

Sherwood Park Greenbelt also voiced concerns over the safety of proposed Alternative 2, citing the possibility of lines falling and children flying kites or climbing towers, as well as the possibility of collision by hot air balloons and small aircraft. If locating the proposed line in the existing right of way within Alternative 1 is considered hazardous to school children, conceptual plans for schools in the area could be modified.

Having regard for the proposed alignment of Alternative 2, which it notes would enclose Colchester School on three sides 80 m away, as well as pass through Hulbert Crescent subdivision and directly over the Edmonton Gun Club, the County was concerned about the safety of all persons along this route.

The County also stated that the alignment of Alternative 2 would be criss-crossed by 18 pipelines at 7 crossing points. It was concerned about the possible corrosion of pipelines because of the flow of electric current induced by the proposed line, believing that a pipeline leak could be lethal to people within 300 m of the pipeline. It further stated that placing the proposed line between the two existing transmission lines along Alternative 1 would not increase the potential safety hazard to the area.

Lehndorff indicated that residential development would be backing onto the transmission line right of way along Alternative 1. It submitted that there would be additional risk, albeit small, in adding a third line between two existing lines.

In response to the suggestion that the towers for the proposed line be fenced off, TransAlta said that fencing would not be necessary because the towers are designed in such a way that they are not easily climbed. TransAlta cautioned that flying kites or other devices in the vicinity of the line would not be prudent, regardless of where it is located.

With regard to some interveners' concerns about the possibility of electrical shocks from fences near the lines, TransAlta stated that the fences are always permanently grounded as a matter of practice to eliminate any induced charge. TransAlta agreed that transmission towers could topple in severe storms, but claimed the structures and conductors would fall within or in very close proximity to the right of way. Therefore, it believed that the towers or conductors would not fall on the Colchester School. Moreover, should a tower collapse, or a conductor snap, the line would automatically be de-energized within milliseconds by built-in protection control devices.

Mr. Hosford has operated his airstrip, located in the NE 1/4 17-52-23 W4M, for 20 years. He indicated that there are 20 to 30 airplanes usually parked at the airstrip. He stated that constructing a transmission line along Alternative 2, which would be located 900 m to the east of his airstrip, would be hazardous to the numerous aircraft using his facility, particularly since the majority of the aircraft would be flying in a westerly direction to land. He agreed that the proposed line along Alternative 2 would fall within guidelines established by Transport Canada; however, he proposed avoiding a new aviation hazard by locating the new line along Alternative 1.

The Edmonton Flying Club submitted that it regularly uses the Hosford airstrip for RCMP Highway Patrol as well as training. It supported Alternative 1, believing that a transmission line along Alternative 2, just 900 m away from the airstrip, would be a hazard to pilots flying at low altitudes or in poor visibility.

The County also stated that, since the Hosford airstrip would be only 900 m away from Alternative 2, a transmission line along this route could pose a hazard to all air traffic using the airstrip.

TransAlta stated that Mr. Hosford's airstrip is located approximately 1600 m from Alternative 1 and about 900 m from Alternative 2. It submitted that the airstrip is not licensed and, even if it were, both routes would comply with Transport Canada's regulations regarding licensed airstrips. In any event, TransAlta would install aircraft warning markers on the overhead shield wires of the transmission lines if Alternative 2 were chosen.

Interprovincial presently operates a tank farm located in the SE 1/4 5-53-23 W4M. It opposed Alternative 2 because it would interfere with future development of a tank farm in the NW 1/4 32-52-23 W4M, adjacent to its existing facilities. Interprovincial stated that the Electrical Protection Act requires a minimum distance of 15 m between the centre line of a 240-kV line and the firewall of a storage tank so that the tanks could not be damaged should a tower collapse. To facilitate operation, maintenance, and emergency access, Interprovincial submitted that a 45-m setback from the centre line would be more appropriate.

In response to Interprovincial's contention that a 45-m setback would be required between the centre line of TransAlta's transmission line and its storage tanks, TransAlta stated that a 15-m setback from the proposed line would meet the Electrical Protection Act minimum distance requirements.

5.2.2 Views of the Board

The Board has carefully considered the evidence presented at the hearing with respect to safety of the proposed transmission line. It has reviewed the evidence to determine if the safety concerns are such that either route should be denied, and, if not, whether safety concerns suggest that one route should be favoured over another.

An initial consideration is the number of people who would be exposed to some potential risk for each of the alternative routes. There are nine residences within 100 m of Alternative 2; other facilities, such as the Edmonton Gun Club and Colchester School, are in close proximity to that route. Currently, there is only one resident within 100 m of Alternative 1 but, in future, a large number of residences in close proximity to that route are likely.

With respect to the planned development along route Alternative 1, some interveners commented that future residents along that route would have a choice as to whether or not to live in the vicinity of the proposed line, whereas residents along Alternative 2 would not. The Board gives some weight to this argument, particularly as it relates to aesthetic concerns, but notes that Lehdorff has already made a commitment to develop the area along Alternative 1, and Lehdorff's interests must be balanced against those of residents living near Alternative 2. More importantly, with respect to the issue of safety under discussion here, the Board believes it has a responsibility to weigh appropriately the interests of future residents along Alternative 1 against the interests of current residents along Alternative 2.

The Board acknowledges the concerns of the interveners regarding the possibility of towers falling, and the danger to children climbing towers or flying kites in the vicinity of the towers. The Board agrees with the applicant that there is minimal danger of children climbing on the towers, as they are designed in such a way as to minimize the risk. Therefore, fencing off the towers is not warranted. The Board also agrees that kite flying in the vicinity of any electrical transmission line is imprudent, but recognizes that there can be no guarantee that such would not happen. It does not believe that the risk of a kite-related accident would be significantly greater on one route than the other, nor that it should deny the application because there is a very small risk that such an imprudent act could cause an accident.

With respect to falling towers, the Board notes that it would take enormous force to cause steel towers such as those proposed to collapse. In either location, in the unlikely event that towers did fall, they

would fall primarily within the right of way and represent little threat to structures outside of the right of way. Also, the conductors would be immediately de-energized.

Alternative 1 already has two sets of towers, one set of 240-kV steel towers similar to those proposed in the application and another set of 138-kV single wood-pole structures. The addition of a third set of towers between these two sets could add a new element to the risk of tower failure. That is, if one of the new towers ever did fall, because of some disastrous event, there is some risk that the falling tower could affect other towers adjacent to it. Again, however, any falling towers would primarily remain within the right of way, posing little danger to structures outside of the right of way.

In any case, the Board believes that the risk of towers falling, even in the event of a natural disaster, is very small and is not sufficient reason to deny the application. Moreover, since there is no evidence to suggest that one route is more prone to natural disaster than the other, nor that the effects would be drastically different, this factor does not strongly favour either route.

In summary, regarding the proximity of the proposed line to residents, the Board recognizes that there are potential safety hazards associated with living in close proximity to transmission lines, as indeed there are such hazards associated with many other aspects of a mobile, industrial society. The risk these hazards pose to the population must be low enough to be acceptable to society. Hazards that can be avoided by the reasonable exercise of individual judgement and responsibility may be acceptable. In the case at hand, and having regard for the existing small population along Alternative 2 and the likely future larger population along Alternative 1, the Board believes that the risks of either alternative are very low and comparable to those associated with many other lines in the province as well as those of other kinds of industrial activity essential to the functioning of modern society. The Board judges these risks low enough to allow the project to go ahead if other issues are satisfactorily resolved. Also, in this case the Board sees no compelling reasons to favour one route over the other on grounds of safety of people in the area.

Regarding Interprovincial's concerns relating to safety in the vicinity of the future oil tank farm, the Board believes that adequate transmission line setback requirements are provided for in the Electrical Protection Act. In this respect, Alternative 1 has a slight advantage over Alternative 2, since no such facilities presently exist along that alignment.

With respect to pipelines, the Board believes that, with appropriate mitigation, there would not be a safety hazard created by placing the proposed line near existing or future pipelines on either route.

The Board acknowledges Mr. Hosford's concerns regarding the potential hazard to his airstrip. However, even if the airstrip were licensed and

the glide path protected by Transport Canada's regulations, both proposed routes would be acceptable under those regulations. As well, TransAlta has indicated that it would provide warning markers on that portion of Alternative 2 in the vicinity of the airstrip. The Board does not believe that either alternative creates an unacceptable hazard to the users of Mr. Hosford's airstrip; however, the potential risk may be somewhat less along Alternative 1 because of greater separation distance.

The Board's overall conclusion regarding safety is that both routes are acceptable. Although neither route has a clear safety advantage, the non-RDA route, Alternative 1, is somewhat more preferable.

5.3 Environmental Issues

5.3.1 The Evidence

Sherwood Park Greenbelt submitted that locating a transmission line in the RDA would create an unpleasant view for residents of Sherwood Park and others in the area, as well as for people using the main highway to Sherwood Park from Edmonton. In comparison, since power lines presently exist along Alternative 1, the additional visual consequences would be minimal.

Hulbert Crescent and Mr. Shaw were concerned about the visual effect of the proposed line since residents of Hulbert Crescent would have one or two towers located in the middle of their subdivision.

The County indicated that placing the proposed line on Alternative 2 would have a negative visual effect on entrances to the County at the Sherwood Park Freeway and Baseline Road.

Lehndorff indicated that placing a third line within the existing narrow right of way in the Meadows area would prevent fully effective landscaping between the towers. It submitted that a new line on Alternative 2 would have 5 to 6 towers per mile. In contrast, three lines in Alternative 1 will have 27 towers per mile, which it believes would compound the visual impact of the transmission lines. It stated that the Meadows area will eventually house approximately 50 000 people, 15 000 of whom will live closer to the proposed Alternative 1 than anyone living in Sherwood Park will be to Alternative 2.

The City of Edmonton indicated that the proposed line along Alternative 1 would conflict with a walkway and landscaping that are planned for the right of way upon which the new line would be located. The City acknowledged that it would still be possible to construct a walkway and plant trees. However, because the height of trees would be restricted, they would not reduce the visual effect of the transmission line.

Witnesses for both Lehndorff and the City suggested that the visual impact of a third line along Alternative 1 would be considerable, and perhaps close to that resulting from a new line along Alternative 2.

TransAlta indicated that locating the transmission line along Alternative 1, between existing transmission lines, and placing new structures adjacent to existing structures, would minimize the visual impact. TransAlta noted the concurrence of Lehndorff's expert witness that Alternative 2 would have more of an incremental aesthetic impact than Alternative 1. It also indicated that Alternative 1 would not interfere with the ability of Lehndorff to landscape or incorporate the right of way as part of an open space with bicycle paths or walkways.

Colchester School indicated that the alignment of the proposed Alternative 2, which is about 3.5 km longer than Alternative 1, would affect more residences and mar the appearance of the area. Colchester School further indicated that, if Alternative 2 were approved, a number of parents might withdraw their children from the school, with the possible result of closure of the school. This would, in turn, result in the loss of an important social, cultural, and recreational centre for the community.

The Sherwood Park Fish and Game Association contended that a transmission line along Alternative 2 would harm the wildlife habitats in the area. It quoted studies stating that "Transmission lines are the major cause of collision-related bird mortality." It also noted that Alberta Environment's stated objective of the RDA is the protection of the natural environment. A number of other interveners agreed that the line would have a detrimental effect on waterfowl flying into several waterbodies in the area.

TransAlta indicated that, along Alternative 2, the line would pass 60 m south and west of Base Line Slough, a staging and production area for waterfowl. The applicant discussed the potential impacts with Alberta Fish and Wildlife, who indicated the effect of the line on waterfowl using the slough would be minimal.

5.3.2 Views of the Board

The Board has evaluated the potential for environmental damage resulting from the line along each of the proposed routes. On the basis of evidence at the hearing, the Board believes the two things which could be most affected would be wildlife and the appearance of the respective landscapes.

The Board recognizes the position put forward by Lehndorff that the cumulative effect along Alternative 1 of placing a third line between two existing lines could be quite significant. The potential impact of the third line is difficult to visualize but some visual complexity is inevitable. TransAlta has proposed erecting the new towers adjacent to the existing steel towers, partly to mitigate the visual impact, but this may enjoy limited success.

At the same time, the Board believes that the addition of such a line to the existing corridor along Alternative 1 would be less visually disruptive than placing it in a green field situation as presently exists along Alternative 2. Also, because Alternative 1 is shorter than Alternative 2, there would be fewer towers and less line length. Therefore, all other things being equal, visual impact should also be less for Alternative 1.

The evidence suggests that in the future (10 years or more) another line might be required through this area, in which case the RDA route could well be chosen. In that event, the visual benefits from choosing Alternative 1 over Alternative 2 could well have a finite time limit. Eventually, both routes could be affected. Nevertheless, the Board believes there is an advantage in choosing Alternative 1 over Alternative 2 in terms of visual impact at the present time.

As to wildlife, especially waterfowl, the Board does not believe the proposed line will have a significant effect. To the extent that there is a potential for impact, Alternative 1 is preferable since the RDA is closer to a number of sloughs.

In comparing the visual and ecological issues associated with the two routes, the Board finds that Alternative 1 is preferable to Alternative 2, although neither route would be denied on these grounds alone.

5.4 Economic and Technical Matters

5.4.1 The Evidence

TransAlta stated that the estimated cost of Alternative 2 (21.1 km in length) would be approximately \$7 million compared to \$5.5 million for Alternative 1 (17.6 km long), a difference of \$1.5 million.

Colchester School, Mr. Shaw, and the County, noting this additional cost, contended that there is no justification to spend an additional \$1.5 million to construct a line along Alternative 2. They further noted that there are a number of additional cost factors, e.g., final alignment of the transmission line in the vicinity of the Edmonton Gun Club, existing residents, and pipelines in place, which may further increase the cost of Alternative 2.

Lehndorff indicated that, when the Government of Alberta acquires all remaining land in the Sherwood Park RDA, TransAlta will have no land cost for Alternative 2. Thus the cost will be reduced by \$712 000 and the net cost difference for the two routes would be about \$800 000. Lehndorff submitted this would be a small price to pay in order to implement the RDA concept.

Trison indicated concern that the proposed line along Alternative 2 would interfere with electrical equipment used in its research and development program. It considered shielding its building; however,

this would be costly and not an effective solution. Trison therefore supported locating the line along Alternative 1. Colchester School and Sherwood Park Greenbelt supported Trison's position and also expressed the view that a line along Alternative 2 would interfere with telecommunication equipment.

TransAlta indicated that it did not believe that Alternative 2 would interfere with existing communication facilities in the area. Edmonton Telephones and Alberta Government Telephones had advised TransAlta that both transmission line routes would cause minimal problems with their facilities, and very little mitigation would be required. TransAlta stated that the line would be constructed and maintained so as to keep interference with radio and television reception within limits acceptable to Communications Canada. In response to the concerns of Trison, TransAlta stated that its proposed transmission line would not interfere with Trison's equipment for electronic measurement because the electric and magnetic field levels attributable to the proposed line at the east boundary of the RDA would be negligible.

5.4.2 Views of the Board

With respect to the estimated costs of the proposed facilities as presented by TransAlta, the Board generally accepts the estimates as reasonable and within TransAlta's normal limits of accuracy. It notes Lehndorff's contention that, once the Government of Alberta has acquired the necessary lands within the RDA, TransAlta will not be obliged to pay anything further for the use of those lands, so that the costs of Alternative 2 would be reduced by \$712 000. On this matter, the Board's view is that the land will be purchased by the Government of Alberta, whether or not the transmission line is located within the RDA. Therefore, costs associated with land purchases should not be considered in the comparison with Alternative 1. However, even without the land costs assigned to Alternative 2, Alternative 1 would be less expensive by some \$800 000 and is therefore preferable.

The Board also notes that a number of interveners raised the question of cost contingencies that might accumulate along either route. Their evidence implied that as much as one million dollars could be added to the estimated costs of Alternative 2. On this matter, the Board observes that Alternative 2 is not as well defined as Alternative 1. The transmission line component within the TUC exists in concept only and has not been actually surveyed. If Alternative 2 were to be selected, the Board believes the component might have to be adjusted to allow construction while accommodating other land uses. This could increase costs to the upper limits of the estimates. This greater uncertainty in the cost estimates for Alternative 2 as compared to Alternative 1 serves to accentuate the higher cost for Alternative 2.

The Board agrees with TransAlta that the proposed transmission line on either route would cause minimal problems with existing communication facilities. The Board notes that TransAlta is required to construct and maintain its line so as to keep any telecommunication interference

within limits acceptable to Communications Canada. In considering Trison's concerns, the Board notes TransAlta's evidence that the EMF strengths of the proposed line would be so negligible that they would not interfere with Trison's equipment. The Board believes that this would be the case. However, if there were any question of interference, the Board would be prepared to investigate the matter further with Trison, TransAlta, and the Federal Department of Communications, and to require any necessary action.

In summary, in evaluating the economic and technical issues, the Board's view is that either route is acceptable but the non-RDA route is preferable.

5.5 Planning and Land Use

5.5.1 The Evidence

TransAlta indicated that Alternative 1 is approximately 17.6 km in length and would be located on an existing right of way. Alternative 2 would be approximately 21.1 km in length, with only 5.2 km located in an existing right of way. Although the latter route would follow RDAs for much of its length, new right of way would be required, either from the Crown or from private landowners.

Most of the interveners favouring Alternative 1 pointed to the additional length of Alternative 2, with the need to obtain additional right of way, as a disadvantage of that route.

Lehndorff, on the other hand, stated that the right of way for Alternative 1, through the Meadows area, is narrower than that recommended in the Weir report. It argued that to allow three lines adjacent to one another in such a narrow right of way would depart from proper planning and result in an unacceptable intensification of lines.

With respect to current and planned land use, Lehndorff stated that Alternative 1 would significantly interfere with future development of the Meadows subdivision. It stated that planning for the Meadows had commenced in 1982 and that it would ultimately accommodate approximately 50 000 people. Lehndorff argued that, since the RDAs had been provided to accommodate electric transmission lines and other utilities, and since future lines will have to follow such routing in any case, placing the currently proposed line in the RDA along Alternative 2 is appropriate.

The City of Edmonton supported Lehndorff in this regard, contending that Alternative 1 goes through an area designated for urban and residential growth. A transmission line along this route would interfere with plans for land use and be an eyesore. The City indicated that the Meadows area structure plan had been designed to recognize constraints imposed by the two existing lines, but not a third line. The City concluded that the line should be placed in RDAs created for that purpose, rather than through a planned residential area.

TransAlta responded to concerns respecting the planned Meadows subdivision by describing ways in which a line could be constructed along Alternative 1 without seriously interfering with planned uses. Several of the interveners also responded to the concerns Lehndorff voiced emphasizing that future residents of the Meadows would have a choice of living next to transmission lines, whereas introduction of a new line along Alternative 2 would impose the line on residents already owning properties and not having a choice.

Respecting use of the RDA, several of the interveners pointed out that, although the area was ultimately planned as a utility corridor, detailed planning is not complete and the precise alignment within the corridor had yet to be determined. They argued that placement of a transmission line along Alternative 2 would make locating other utilities in the RDA more difficult in the future. They emphasized that the RDA is needed for future pipelines and highways and should be reserved for that purpose. Lehndorff responded by indicating that the RDA is intended for electric transmission lines as well as for other utilities, and that it should be used for that purpose at this time.

In dealing with Lehndorff's contention that the RDA is going to be used for future transmission lines in any case, TransAlta stated that it did not see the need for additional 240-kV transmission facilities in the region for at least 10 years. It also stated that it has no plans to abandon or relocate the existing facilities along Alternative 1. The latter point was in response to evidence from The City of Edmonton suggesting that all of the power lines along Alternative 1 could eventually be relocated. The City contended that adding a line to that route would likely eliminate that possibility.

Several of the interveners opposed to Alternative 2 also pointed to the current use of the land along that route which had the potential to be significantly affected. Interprovincial expressed concern because of potential interference with future expansion of its oil tank farm into the NW 1/4 32-52-23 W4M, adjacent to its existing facility. Its evidence suggested that a line along Alternative 2 could sterilize up to 18 acres of land intended for future storage tanks. A number of other interveners pointed to this as another reason to select Alternative 1.

TransAlta, in response, submitted evidence indicating that only 10 acres of Interprovincial's property would be sterilized.

A number of the interveners opposed to Alternative 2 contended that placing the line along that route would decrease the value of adjacent properties. They contended that the value of the properties located along Alternative 1 would not decrease because the presence of the existing lines already has an effect on their value. Sherwood Park Greenbelt indicated that local realtors had advised them their properties would decrease in value by some 15 per cent if Alternative 2 were chosen.

TransAlta, in responding to these concerns, indicated that it is not aware of any evidence suggesting that the presence of power lines has an effect on the value of nearby properties. It formed this conclusion after both the Alberta Surface Rights Board and the Court of Queen's Bench had examined the issue.

Mr. Hosford indicated concern that the proposed transmission line would interfere with his on-going farming operations if Alternative 2 were approved.

5.5.2 Views of the Board

On the subject of planning and land use, the Board has reviewed the evidence for indications that either route should be rejected or that one route has an advantage in these terms.

In comparison, Alternative 2 is approximately 3.5 km longer than Alternative 1 and would require new right of way for much of its length. The Board therefore believes that Alternative 1 has an advantage because of its shorter length.

With respect to Lehdorff's contention that portions of the right of way through the Meadows are narrower than recommended, in the Board's view, using the existing right of way would be adequate for construction, maintenance, and safe operation of the transmission lines.

The Board realizes that placing a line along Alternative 1 would result in three lines in a common corridor. It believes, however, that the effect on land use of adding a third line between two existing lines would be less than placing a new line in a new location along Alternative 2.

With respect to current and future land use, the Board believes that constructing a line along Alternative 1 should not cause major interference with future development of the Meadows subdivision, since the area was designed and developed with the constraints and consequences associated with the two existing lines taken into account. The Board notes The City of Edmonton's concern that a third line would conflict with proposed walkways and landscaping of the existing open area. In the Board's view an additional line would not preclude such development taking place but may have some impact. Therefore, Alternative 2 is slightly preferable in this regard.

In regard to Lehdorff's contention that the TUC would, in any case, be used for future transmission lines, the Board notes evidence presented at the hearing that any new facilities in the East Edmonton area would be at least 10 years away. The Board also recognizes that relocation of existing transmission lines off of Alternative 1 is unlikely.

The precise alignment of the power transmission component within the TUC has not been determined, and additional work would be required if Alternative 2 were chosen. In the Board's opinion, this is not a major

constraint precluding the use of Alternative 2, as future development within the RDA could be accommodated with adequate planning. Nevertheless, in comparing the two proposed routes, the Board believes that there are some advantages to Alternative 1, since a well-defined right of way presently exists for much of the route. This right of way has already figured in the planning and designing of future development along Alternative 1.

Regarding Interprovincial's concern about potential interference with a future tank farm, the Board agrees with TransAlta that approximately 10 acres, not 18 acres, could be sterilized. Although a transmission line along Alternative 2 can co-exist with a facility such as a tank farm, locating the line along Alternative 1 would be preferable.

Several interveners contended that the proposed line would decrease property values in areas adjacent to the line. In this regard, there was not sufficient evidence to support a prediction of reduced property values on either route. The Board notes that some interveners were concerned with interference in farming operations. The Board does not believe that building the line on either route would cause major interference in this regard.

In summary, the Board does not believe that any of the issues or concerns raised about planning or land use by the participants were so serious as to cause denial of either of the routes. In comparing the two proposed routes, the Board concludes that Alternative 1 is slightly preferable with respect to planning and land use.

6 CONCLUSION REGARDING THE PROPOSED ROUTES

It remains to be considered whether the cumulative concerns regarding safety, risk to the environment, costs, and planning and land use are sufficient to cause the Board to deny the application or, failing that, to choose one route over the other. The Board believes that the sum of all concerns raised by interveners does not provide sufficient grounds to deny the application. The potential adverse effects of either route are outweighed by the overall benefits of constructing the new 240-kV transmission line between TransAlta's Ellerslie substation and its East Edmonton substation.

As to the choice of routes, the Board notes that almost all of the comparisons discussed earlier either favour Alternative 1 or are neutral with respect to location. The Board therefore concludes that the westerly Alternative Route 1, TransAlta's preferred route, is the most appropriate choice.

7 DECISION

The Board is satisfied that the need for the proposed line and the benefits that would result from it outweigh any negative consequences associated with its construction and operation. The Board has therefore decided:

1. To approve construction of a 240-kV double-circuit steel tower transmission line, to be designated as 946/947L, from Ellerslie substation 89S to East Edmonton substation 38S, along the Alternative 1 alignment as described in the application.
2. To approve the connection of the two 240-kV transmission circuits to the Ellerslie substation 89S.
3. To approve the connection of the two 240-kV transmission circuits to the East Edmonton substation 38S.
4. To approve other related alterations.

Although the Board, as indicated in this report, has assessed the TransAlta application in detail and is satisfied that it should be approved, it believes it must deal with one other aspect of the matter before it. In its original intervention, The City of Edmonton had requested that the Board issue an order that Edmonton Power share in the ownership of the transmission line applied for by TransAlta. After discussion with Board staff, Edmonton Power withdrew that portion of its intervention.

Subsequent to the subject hearing, Edmonton Power applied to the ERCB for an order requiring TransAlta to provide a 50 per cent ownership in an existing transmission system, the 500-kV system between Keephills and Ellerslie. TransAlta argued that the Act does not authorize the Board to order the transfer of ownership in a transmission system. The Board addressed that jurisdictional matter and received written argument from TransAlta, Edmonton Power, and the Industrial Power Consumers Association of Alberta.

The Board had not, prior to the 500-kV Keephills-Ellerslie case, dealt with a specific request for an order directing a transfer of ownership. It had, therefore, never provided an opportunity for comment, nor received a challenge, as to its jurisdiction regarding the ownership question.

After considering the written arguments of interested parties, the Board, in a Memorandum of Decision issued 1 May 1989, concluded that it was not satisfied that section 17(2)(e) of the Act authorizes it to order the transfer of ownership of all or part of an electric transmission system.

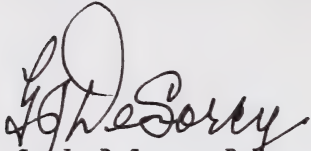
On the basis of what has recently transpired, the Board concludes that had Edmonton Power not withdrawn a portion of its intervention, the question of ownership of the line would have been dealt with at the subject hearing. Since this did not occur, the Board recognizes that Edmonton Power may wish to pursue the matter at this time.

For this reason, the Board will not proceed with a request for Ministerial approvals, or the issuance of the ERCB approvals, until

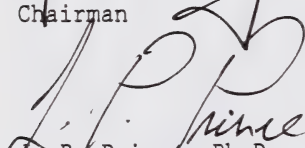
Edmonton Power has had an opportunity to consider whether it believes its situation was prejudiced by the above described sequence of events, and to make related representations to the Board.

DATED at Calgary, Alberta, on 10 May 1989.

ENERGY RESOURCES CONSERVATION BOARD



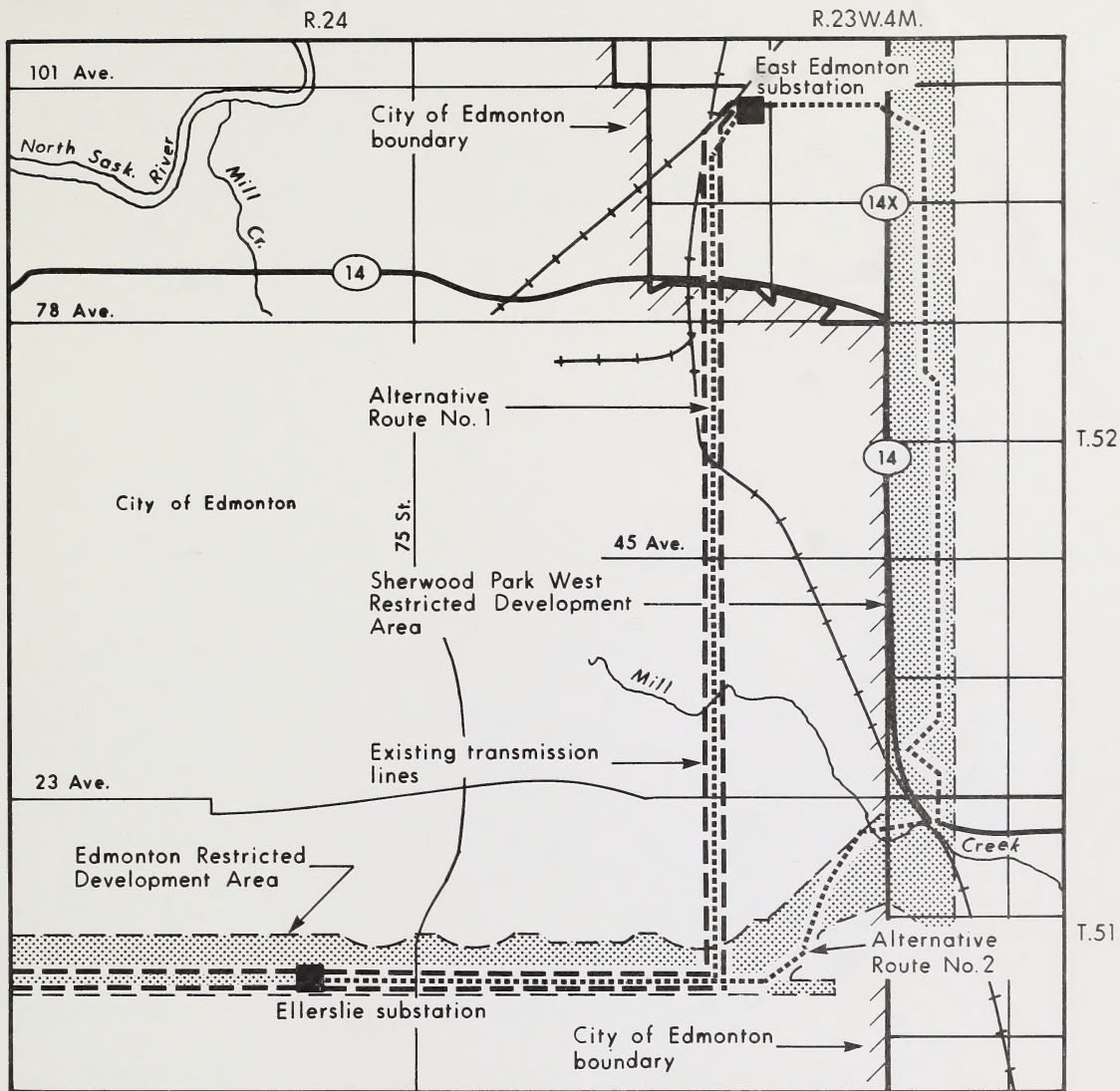
G. J. DeSorcy, P.Eng.
Chairman



A. P. Prince, Ph.D.
Board Member



Dr. R. R. Orford, M.D., C.M.
Acting Board Member



PROPOSED TRANSALTA EAST EDMONTON TRANSMISSION LINE 946/947L

Application No. 880953

TransAlta Utilities Corporation

N.L.C. - B.N.C.



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